Using Cellular Automata to Model the Gun Violence Epidemic in Chicago, IL

In 2013, the CDC reported that 3.5 per 100,000 deaths resulted from firearm-induced homicide. Despite overall national reductions in fatal and nonfatal shootings since the 1990s, gun violence remains a major problem in communities nationwide, including Chicago, Illinois. Gun violence has often been referred to as an "epidemic," but limited research exists comparing the issue to a disease. We hypothesize that a cellular automata (CA) epidemic model can appropriately determine the conditions that lead to an outbreak of gun violence and expose some underlying causes of propagation. A CA model consists of an array of cells, each with a defined state. With each time step, the cellular states are updated based on fairly simple rules. We simulate gun violence by combining tenets of SEIR models with spatially explicit CA models. We show that a modified *sand pile model* can approximate the spread of violence in Chicago. This model serves as a predictive tool to determine where outbreaks of violence might take place, as well as an extrapolative tool for explaining why and how these acts of violence occur.

Keywords: gun violence, cellular automata, epidemic models